Selected Methods of Assessing Human Health and Safety

Risk

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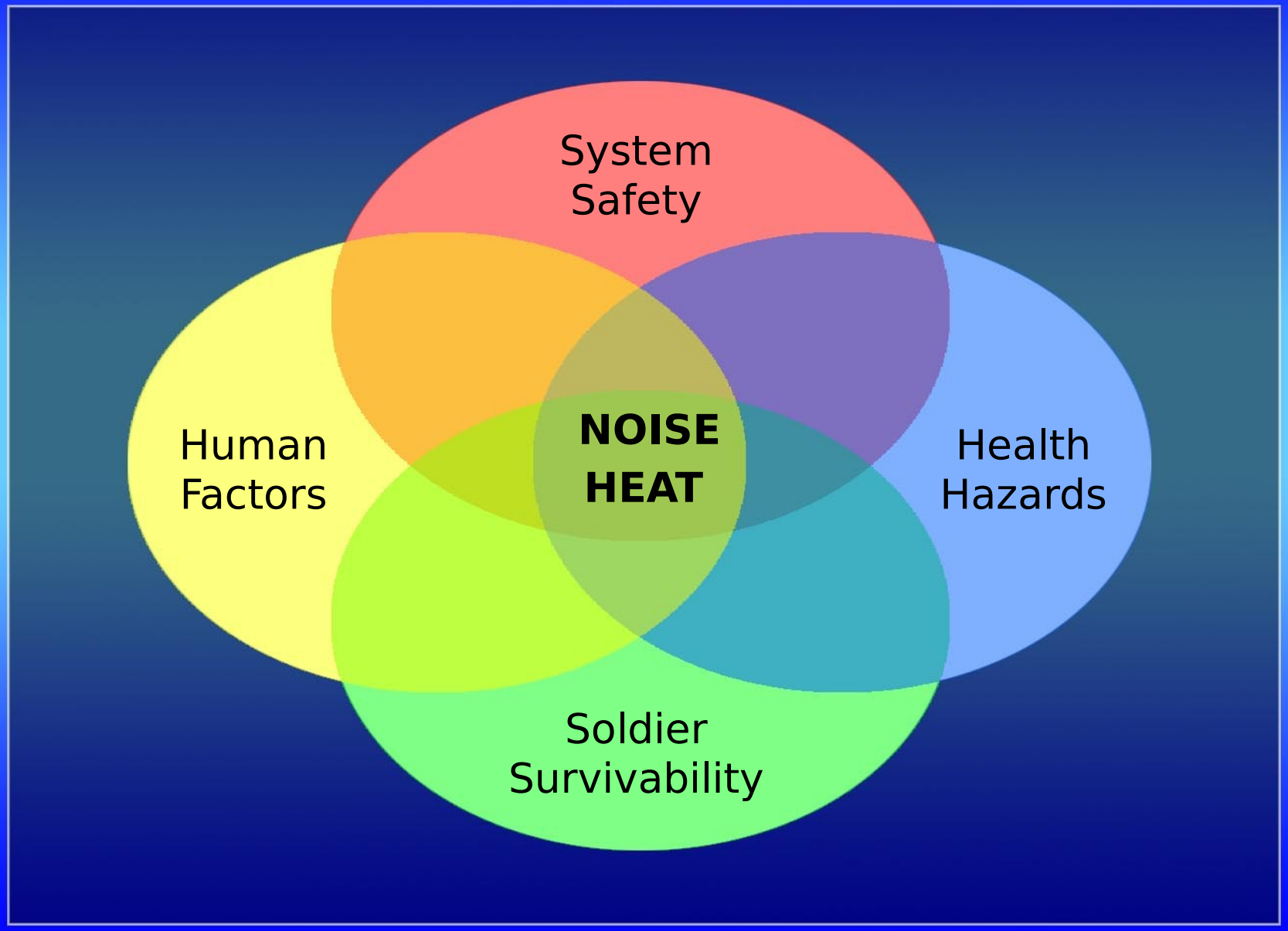
Outline

- Introduction
- General Risk Assessment Discussion
- System Safety Assessment
- Health Hazard Assessment
- Environmental Health Risk Assessment
- Summary
- Questions

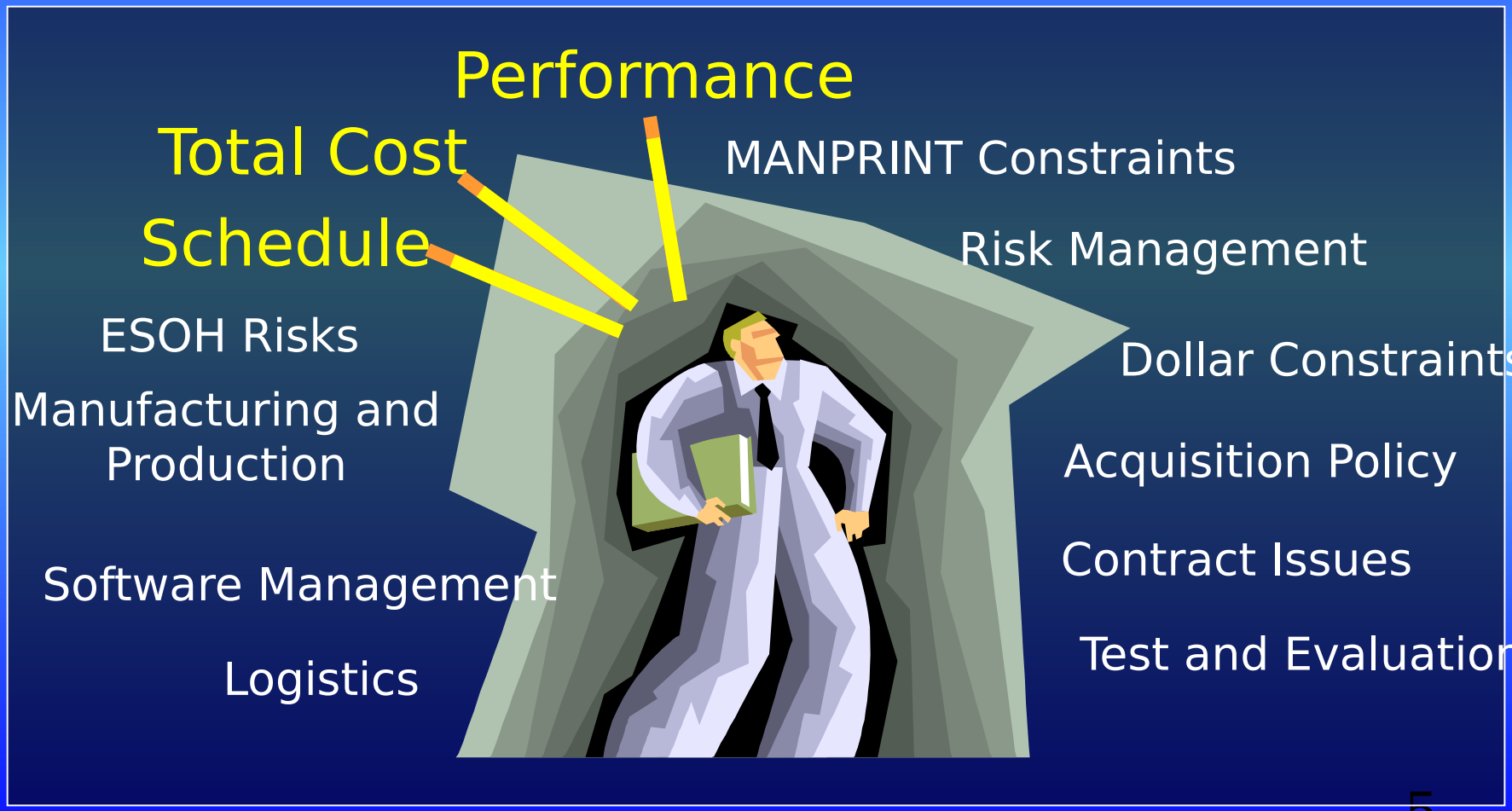
Purpose

- Provide an overview of selected risk assessment methods used by health and safety professionals.
- Encourage MANPRINT community to develop common risk assessment methodologies.

MANPRINT Domain Interactions



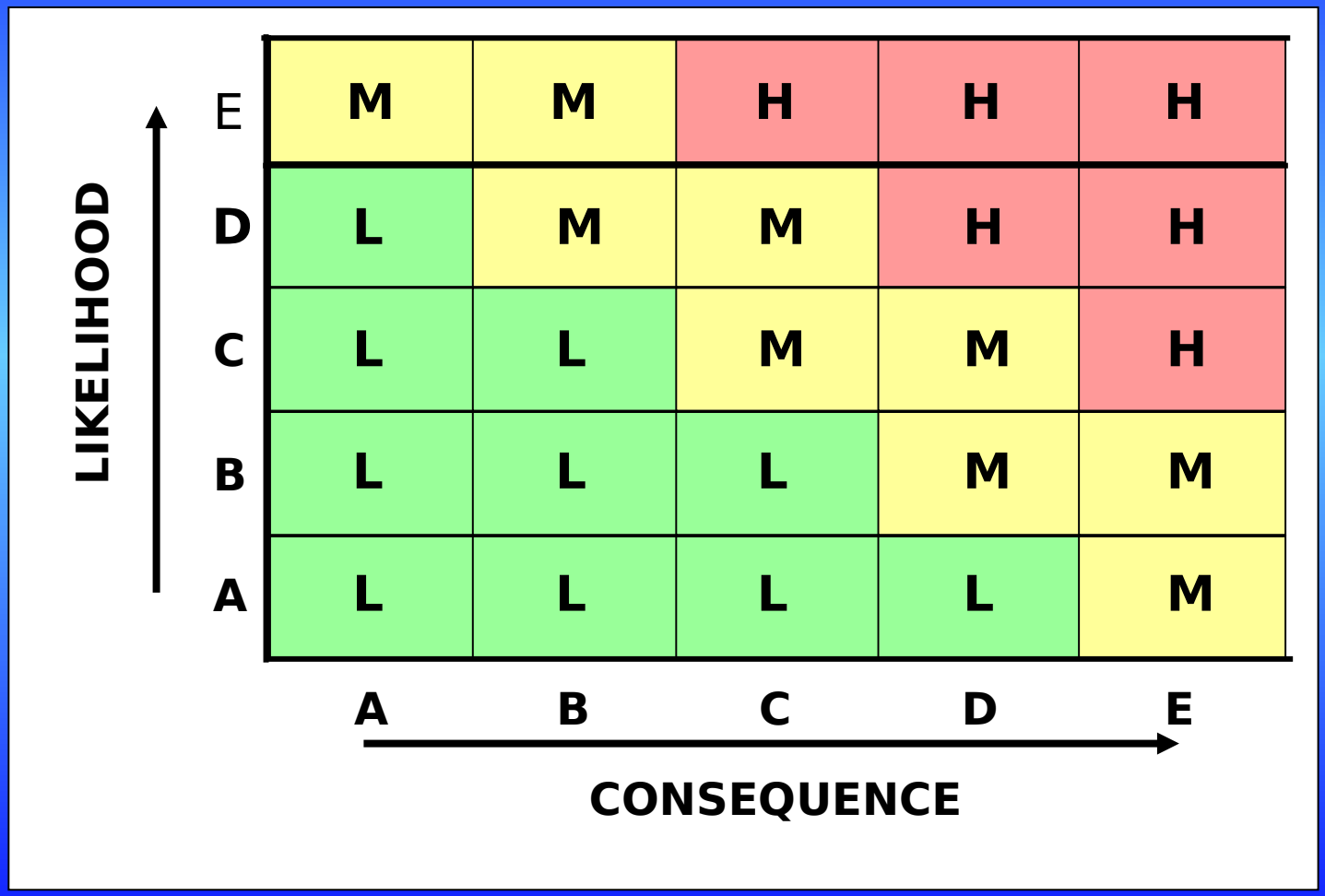
SYSTEM PROGRAM MANAGER RESPONSIBILITIES



Programmatic Risk Management

(DoD Acquisition Guide)

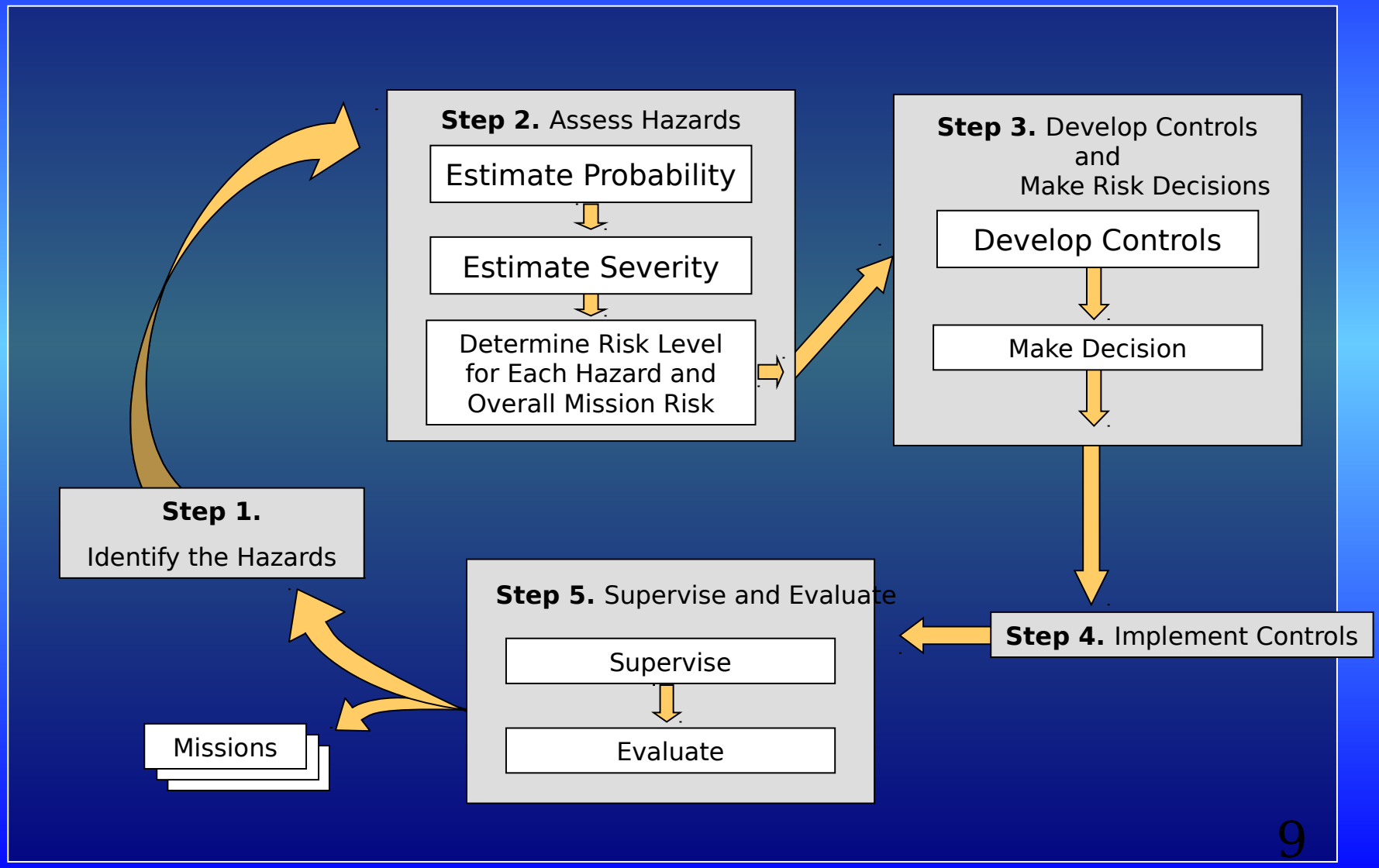
Program Risk Matrix
(DoD Acquisition Guide)



Operational Risk Management

Operational Risk Management

(FM 100-14)



Operational Risk Matrix
(FM 100-14)

Probability						
Severity		**Frequent A**	**Likely B**	**Occasional C**	**Seldom D**	**Unlikely E**
Catastrophic	**I**	**E**	**E**	**H**	**H**	**M**
Critical	**II**	**E**	**H**	**H**	**M**	**L**
Marginal	**III**	**H**	**M**	**M**	**L**	**L**
Negligible	**IV**	**M**	**L**	**L**	**L**	**L**

E - Extremely High Risk
H - High Risk
M - Moderate Risk
L - Low Risk

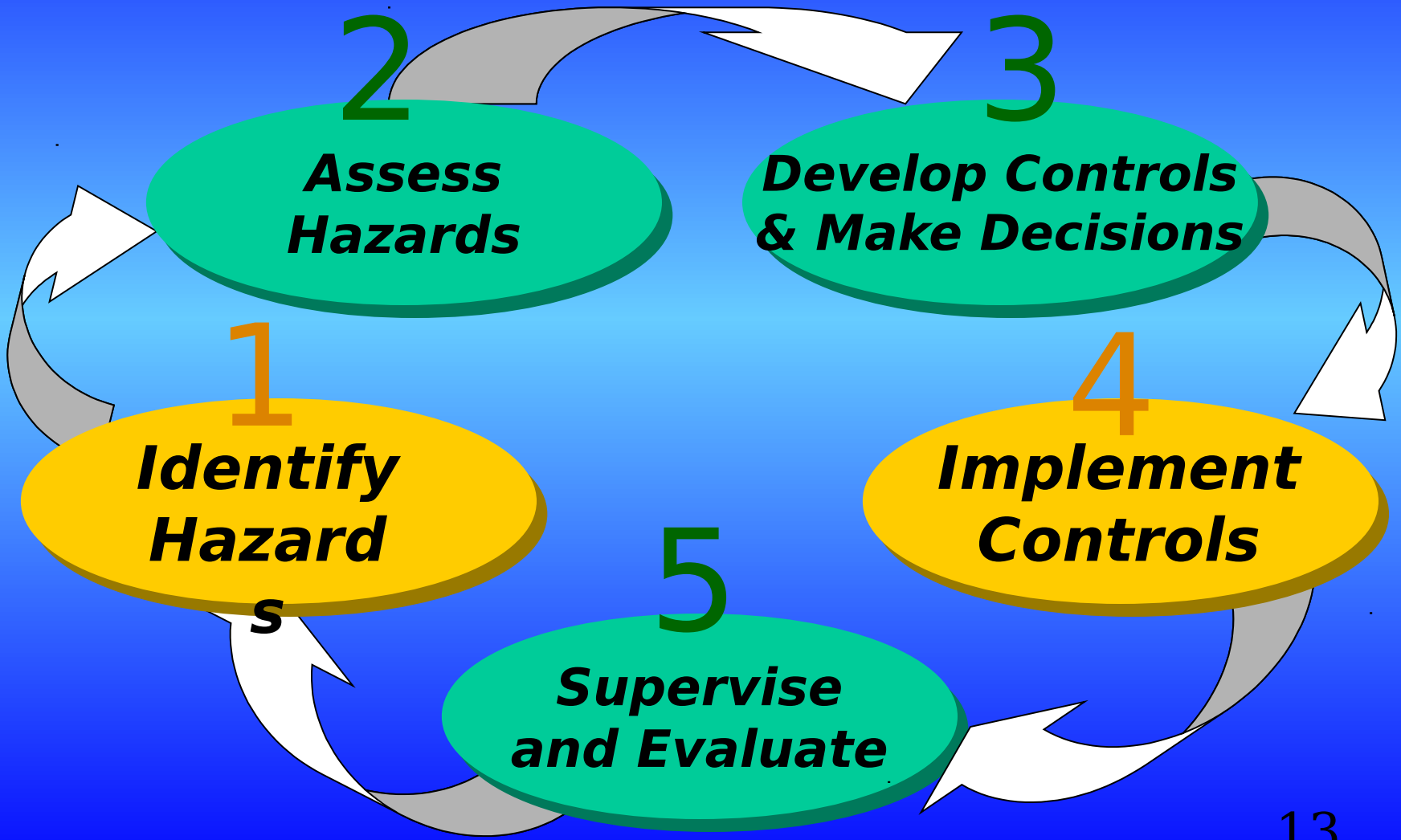
MIL-STD-882D Standard Practice For System Safety

- States DOD's commitment to protecting people from accidental injury, equipment/ systems from damage, and the natural environment from degradation.
- Provides a generalized approach to identify, assess, and manage safety, health, and environment risks.

Definitions

- Hazard- Any condition that can cause death, injury, illness, death, or damage to people, equipment, or the environment.
- Risk- An expression of the impact and possibility of the hazard in terms of severity and probability.

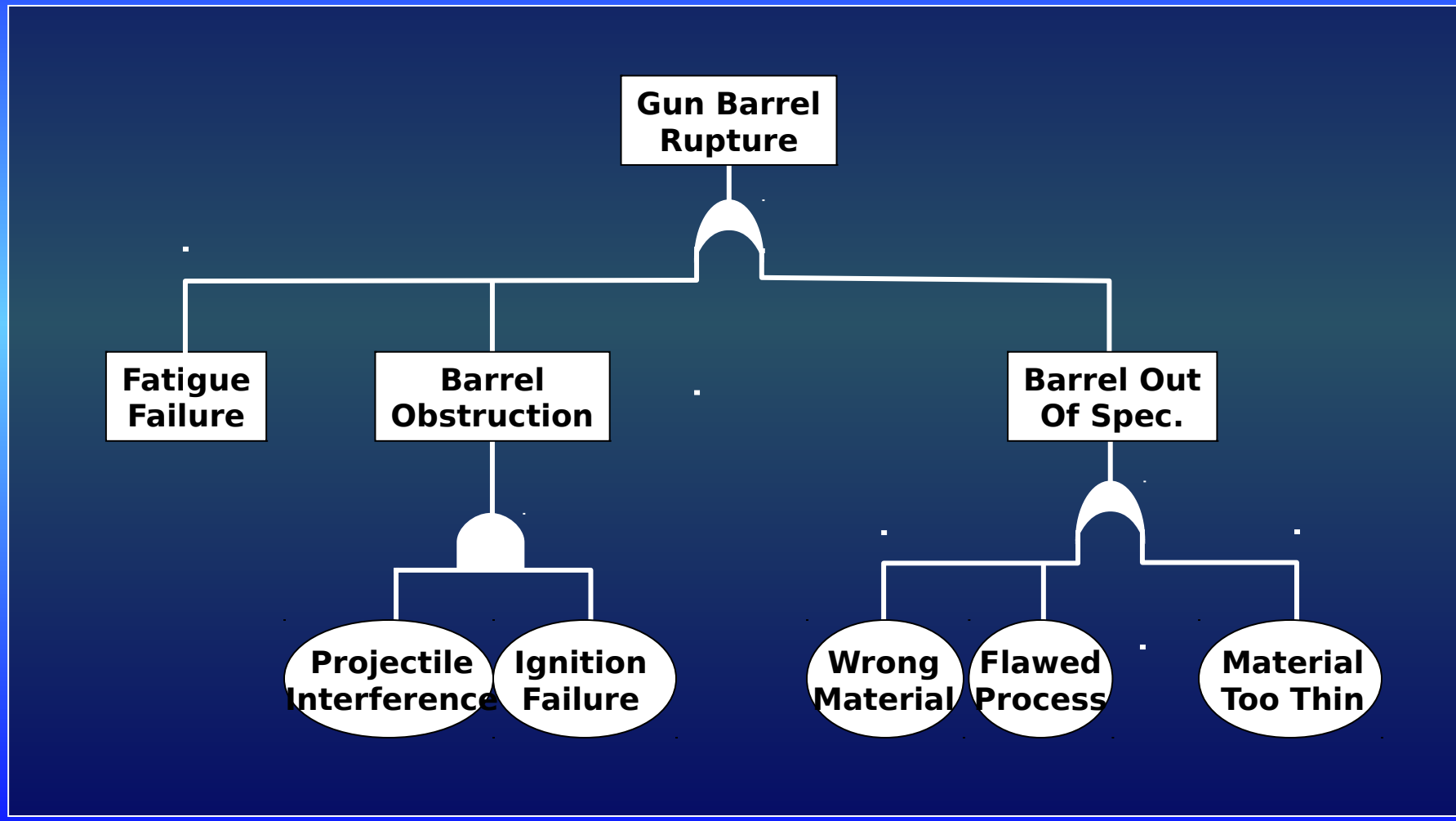
Army Safety
Risk Management Process



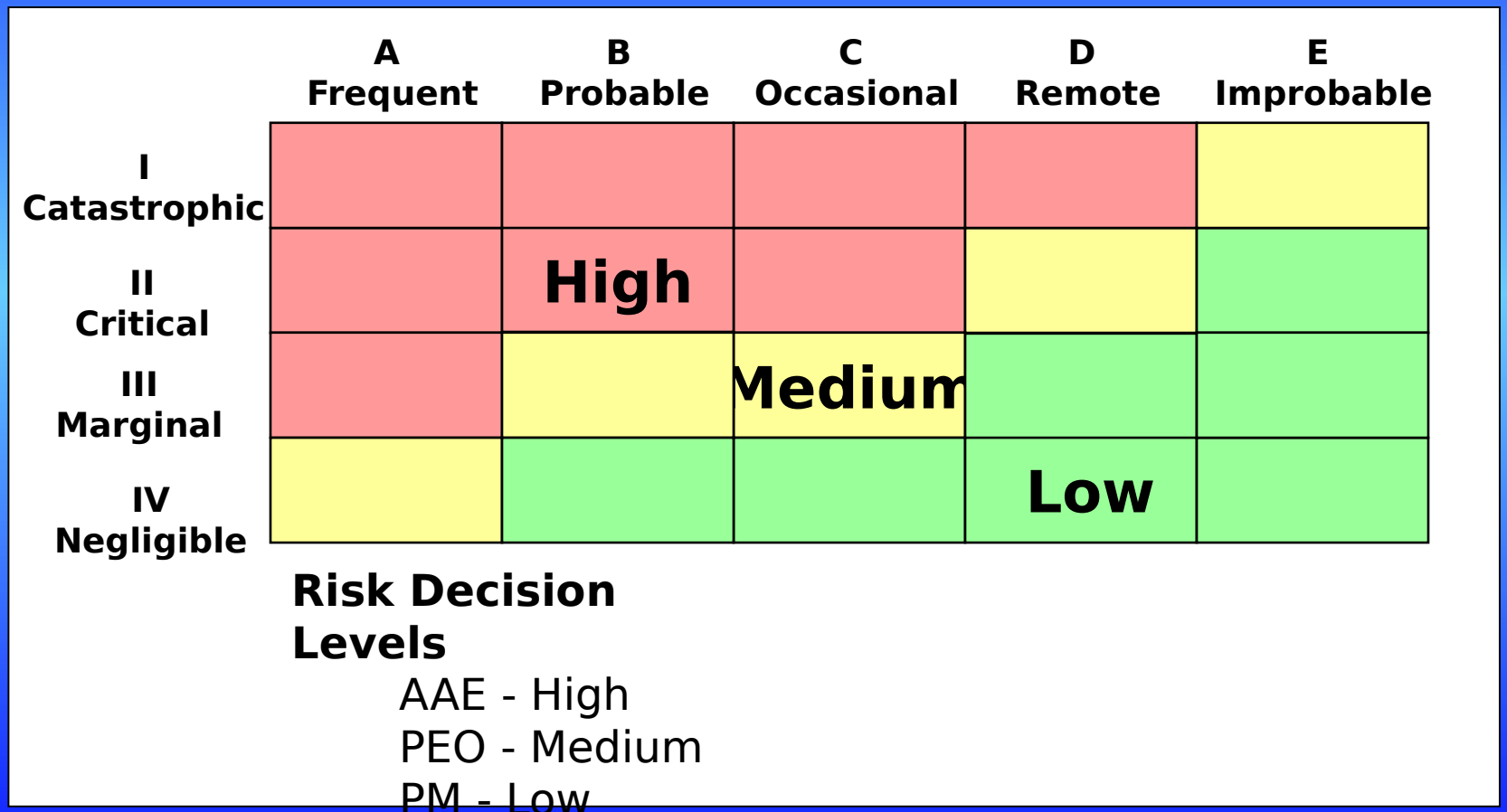
Techniques for Identifying the Hazards

- Failure Modes and Effects Analysis
- Fault Tree Analysis
- Energy Analysis
- What-if Analysis

Fault Tree Example



System Safety Risk Matrix

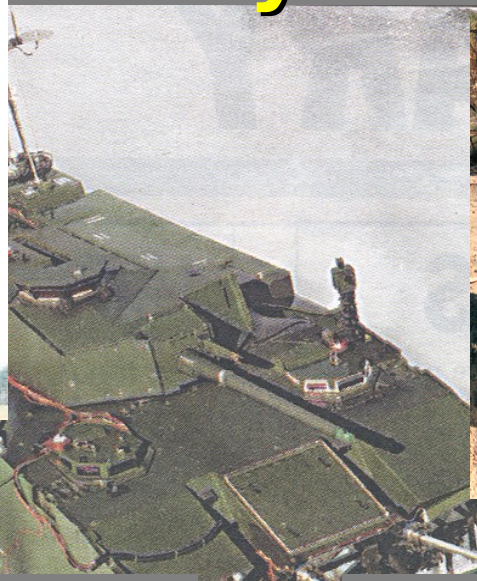


Risk Decision Levels

AAE - High
PEO - Medium
PM - Low

Health Hazard Categories Addressed by the HHA Program

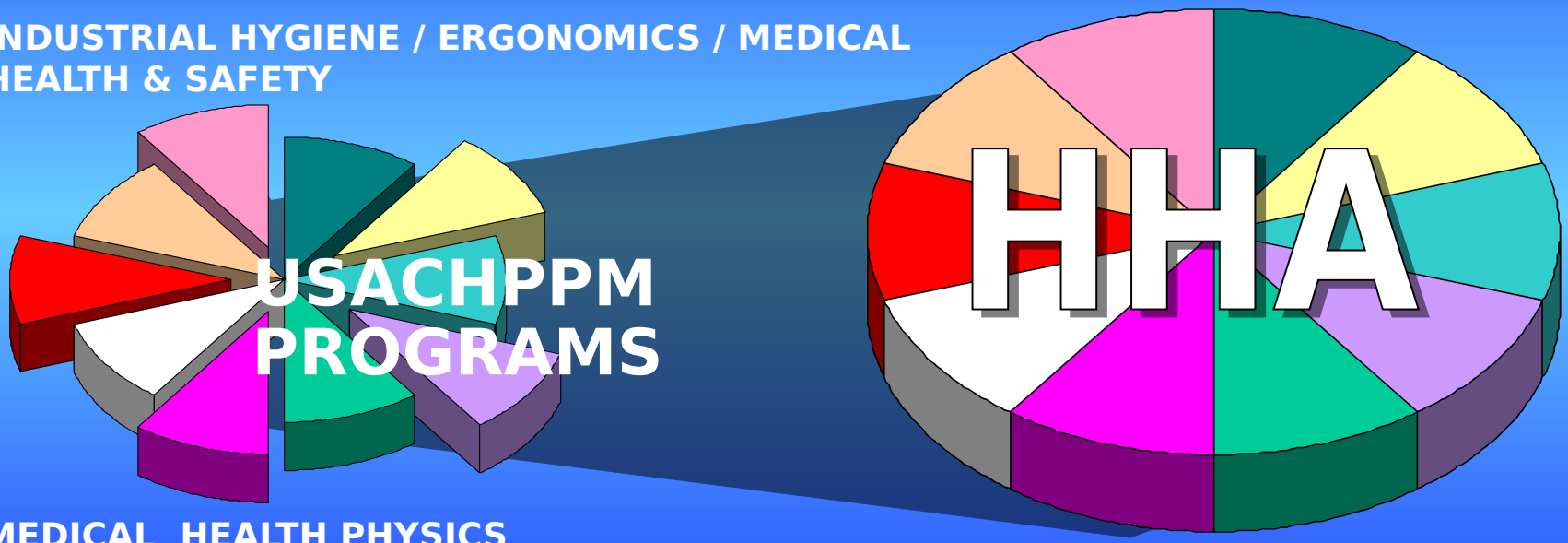
- ACOUSTIC ENERGY
- BIOLOGICAL SUBSTANCES
- CHEMICAL SUBSTANCES
- RADIATION ENERGY
- SHOCK
- TRAUMA
- VIBRATION
- TEMPERATURE EXTREMES
- OXYGEN DEFICIENCY



USACHPPM

- ENVIRONMENTAL HEALTH ENGINEERING
- HEALTH HAZARD ASSESSMENT
- HEARING CONSERVATION
- ENTOMOLOGICAL SCIENCES
- INDUSTRIAL HYGIENE / ERGONOMICS / MEDICAL HEALTH & SAFETY

Support



- MEDICAL HEALTH PHYSICS
- TOXICITY EVALUATION
- LASER-OPTICAL RADIATION
- RADIOFREQUENCY/ULTRASOUND
- OCCUPATIONAL MEDICINE

HHA and Risk Management Model

ASSESSING HEALTH RISK

(Risk Assessment Code Matrix)

High ⟷ Low

Severity	Hazard Probability				
	A	B	C	D	E
I	1	1	1	2	3
II	1	1	2	3	4
III	2	3	3	4	5
IV	3	4	5	5	5

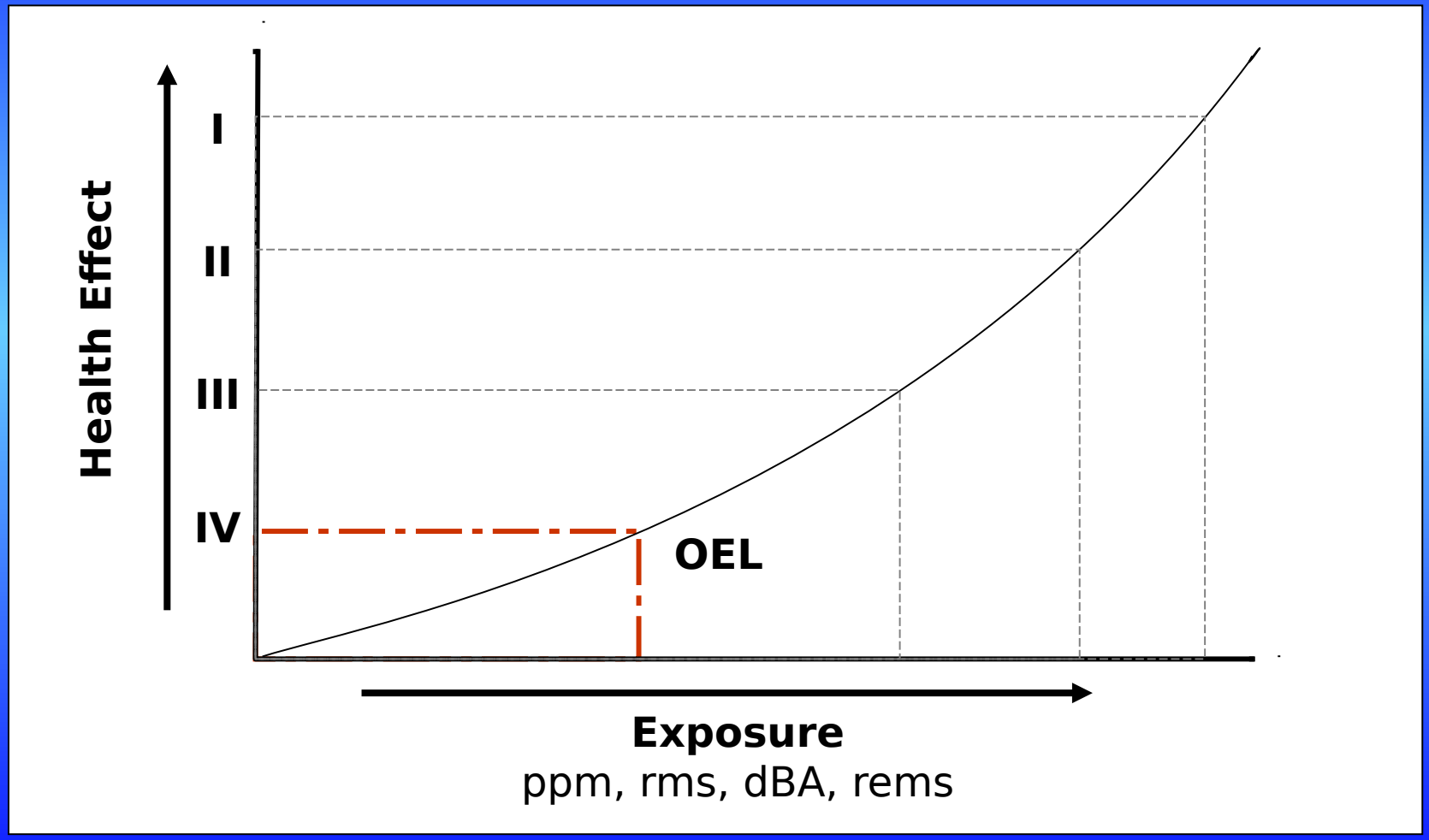
High ↕ Low

*AR 40-10

Hazard Severity Categories

HS	Description
I	Catastrophic: Hazard may cause death or total loss of bodily system.
II	Critical: Hazard may cause severe bodily injury, severe occupational illness or major damage to bodily system.
III	Marginal: Hazard may cause minor bodily injury, minor occupational illness, or minor damage to a bodily system.
IV	Negligible: Hazard would cause less than minor bodily injury, occupational illness or minor damage to a bodily system.

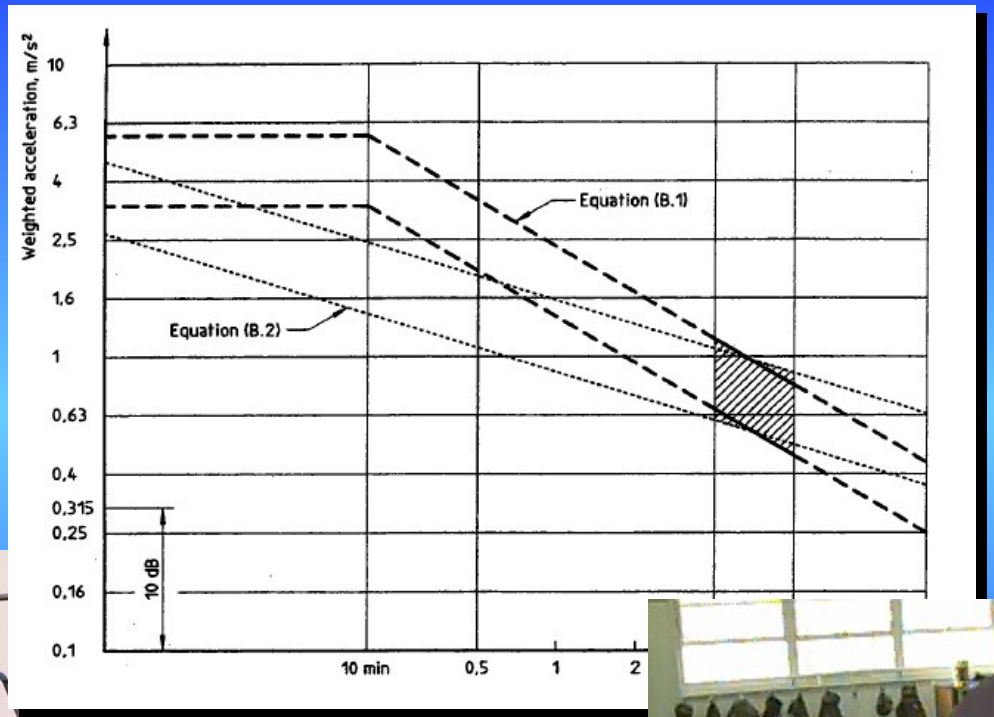
Health Hazard Severity



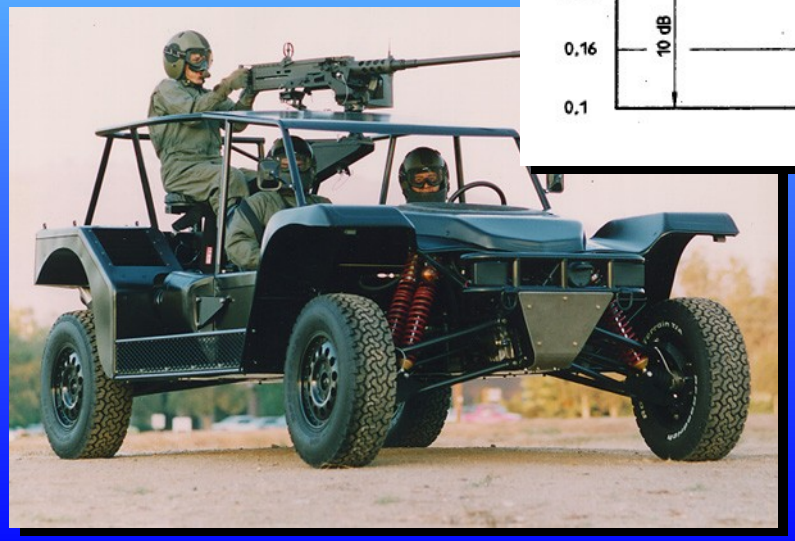
Hazard Probability Levels

HP	Description
A	Frequent: Likely to occur frequently
B	Probable: Will occur several times in the life of an item
C	Occasional: Likely to occur sometime in the life of an item
D	Remote: Unlikely but possible to occur
E	Improbable: Assumed occurrence may not be experienced

Vibration Hazard



Whole-body Vibration



Segmental Vibration

Whole Body Vibration 1 - 80

- Spinal column disease
- Digestive system problems
- Cardiovascular effects
- Discomfort
- Loss of balance and concentration
- Fatigue, insomnia, headache and "shakiness“
- Circulatory, bowel, respiratory, muscular and back disorders

WBV and Repeated Jolt Acceleration Data - [Page 1: Data Selection and Signal Processing]

File Name: SRSDL07 | Speed: 07 mph | Terrain: Perryman Secondary " | Seat: Port Aisle | Vehicle / System: EFV (Command Variant) C1

STEP 1: Data Set Selection

File format: BCR (•) APG ( ) Text ( ) Browse

Path: C:\WBV Data\BCR\EFV C1\PAISLE\

Files:
- SRSDL07
- SRSDL10
- SRSDL12
- SRSDL15
- SRSDL18
- SRSDL20

OK

STEP 2: Signal Processing

Original rate	2048	Hz	92160	samples
Reduced to	160	Hz	7201	samples

AC Coupling: High Pass (•) Avg. ( ) None ( )

Status: Processing Completed. OK

File header:

```
Description:     C1 Vibration and Noise Testing
Test Location:   Aberdeen Proving Ground
Description:     EFV (Command Variant) C1, Stee
Vehicle Type:    C1 Vibration and Noise Testing
Test Terrain:    Perryman Secondary "A"
Vehicle Speed:   07 mph
```

```
Number of Channels:   3
Samples per Channel:  92160
Sampling Rate (Hz):   2048
Signal Duration (s):  45.0
```

```
01  seat x acceleration     m/s^2   XAC seat
02  seat y acceleration     m/s^2   YAC seat
03  seat z acceleration     m/s^2   ZAC seat
```

STEP 3: Assumptions for Exposure Calculation

		h	m	s		
Duration of daily exposure	Td =	8	0	0	Age (years) at start of exposure	b = 20
Exposure days per year	days =	240			Expected years of exposure	n = 20

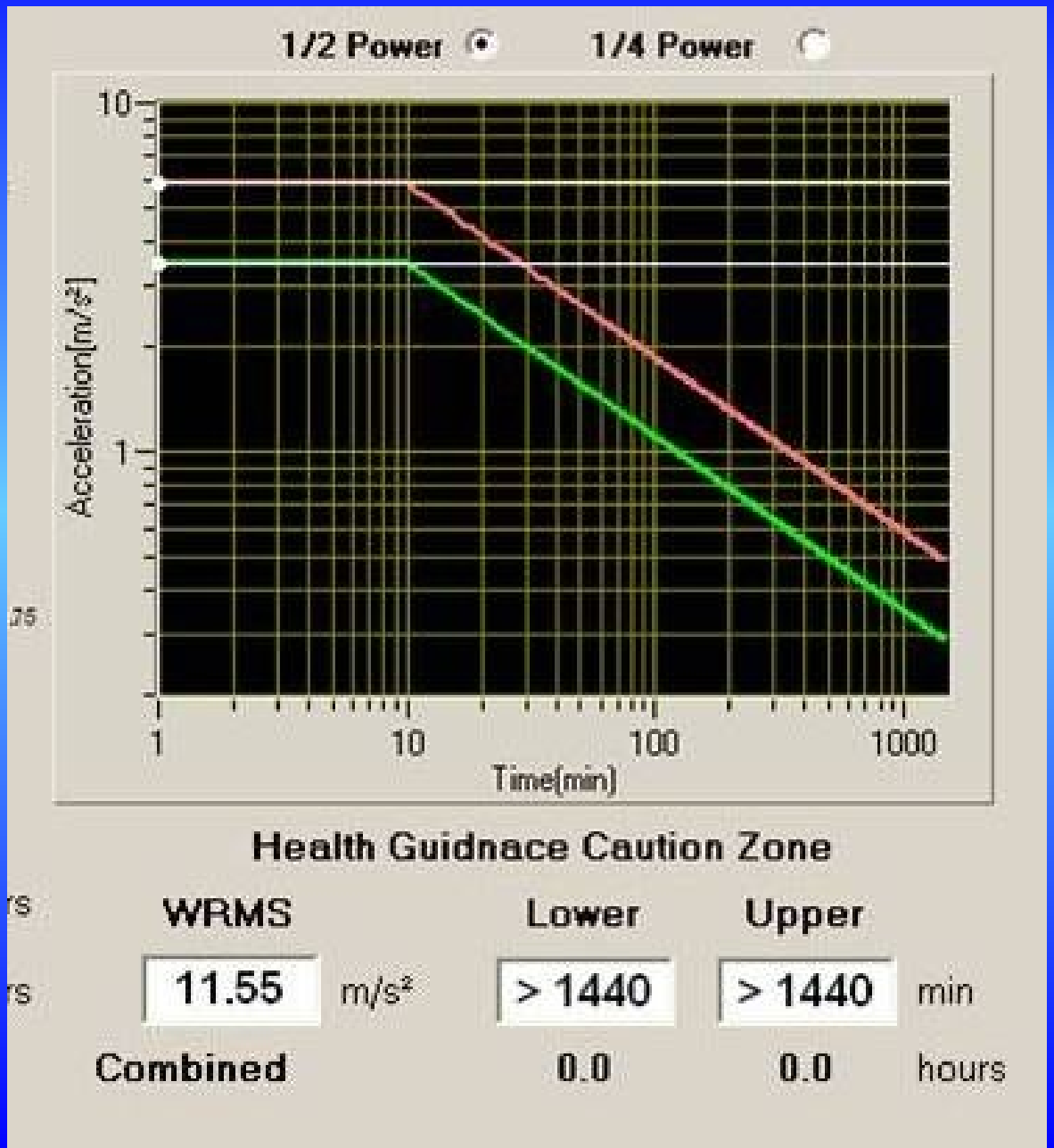
Process all folders in specified path... Process

Summary file... Delete Open

Exit

start | Inbox - Microsoft ... | SLI | Human Vibrati... | wbv.ppt | Support | WBV and Repeated... | 3:38 PM

Health Guidance Caution Zone ISO 2



USAARL Guidelines for Assigning Hazard Severity

WBV Daily Exposure Limits	Category No. And Label	Adverse health effects that may be caused by WBV
< 2 minutes	I Catastrophic	Death or total loss of a bodily
2 – 20 minutes	II Critical	Severe bodily injury, severe occupational illness, or major damage to a bodily system.
20 min – 3 hours	III Marginal	Minor bodily damage, minor occupational illness, or minor damage to a bodily system